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<p>(54) Title: A METHOD FOR FREEZING GOODS</p> <p>(57) Abstract</p> <p>A plate freezer (2) consists of a stack of horizontal freezer plates (14, 15) provided with spaces for goods, wherein the plates are vertically movable between vertical columns (22), and have an intake side for intake of goods and an outlet side for removal of goods placed at 180° in relation to each other. The goods are frozen by placing them in a first freezer frame (16) which is passed to the intake side of the plate freezer (2), and into an extended space in the stack. The stack is lifted by means of a suitable lifting device, and the extended space is formed by bringing stoppers on the first and second frame carriers (3, 4) over contact surfaces connected with the columns (22) and on into the stack, whereupon the stack is lowered so that the part of the stack which is located over the stoppers remains lying on the stoppers, pressing the stoppers down towards the contact surfaces.</p>			

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## A Method for Freezing Goods

The invention concerns a method for freezing goods by means of one or more plate freezers, wherein each plate freezer consists of a stack of vertically movable horizontal freezer plates arranged with spaces for goods, wherein 5 the stack is arranged between vertical columns, and has an intake side for the intake of goods and an outlet side for the removal of goods placed at 180° in relation to each other, and wherein the goods are frozen in a cycle which comprises the following steps:

- 10 a) the goods are placed in a first freezer frame and the first freezer frame is transferred via a first conveyor to a first frame carrier,
- b) the first frame carrier is placed with the first freezer frame on the intake side of the stack of plates,
- c) a second frame carrier is placed on the outlet side of the stack of plates, aligned with the first frame carrier,
- 15 d) one of the spaces in the stack is extended, aligned with the first and the second frame carrier,
- e) the first freezer frame is pushed into the extended space, where the first freezer frame pushes a second freezer frame with frozen goods out of the extended space and out on to the second frame carrier, transferring the second freezer frame to a second conveyor,

whereupon the above steps are repeated for the other spaces in the stack of plates.

The invention also concerns a device comprising a plate freezer consisting of a stack of vertically movable horizontal freezer plates arranged with spaces for goods, wherein the stack is arranged between vertical columns, wherein the stack has an intake side for the intake of goods and an outlet side for the removal of goods placed at 180° in relation to each other, wherein before 25 freezing the goods are placed in a freezer frame which is passed via a first conveyor to the intake side of the plate freezer, and wherein after freezing the freezer frame is transferred to a second conveyor.

Plate freezers are commonly used for deep-freezing foodstuffs such as fish, and are employed both in factories on land and on board boats.

A plate freezer generally comprises a stack of freezer plates, and the goods are placed in between these plates and are pressed against them. When goods are inserted and removed, an extended space has to be established between the plates. This is done in the prior art by lifting the stack, inserting pawls 5 therein, and then lowering the stack, thus forming an extended space under the pawls.

NO 172 817 C describes a plate freezer of the above-mentioned type. A number of plate freezers are located beside one another, with the result that the intake sides of the plate freezers are situated beside one another on one 10 side of the row, and the outlet sides of the plate freezers are situated beside one another on the other side of the row. A conveyor belt is provided on the intake side and the outlet side of the row for the supply of fresh goods and the removal of frozen goods. The stack of plates can be moved vertically, and a system of pawls and hydraulic cylinders raise and lower the stack and 15 ensure that an extended space is established between two freezer plates in alignment with the conveyor belt. After a plate freezer has been filled, it is placed under pressure by means of hydraulic cylinders, thus providing good heat transfer from the goods to the freezer plates. The freezer plates are then cooled by means of a freezing medium during a freezing period, whereupon 20 the freezer frames are released from the freezer plates by a thawing medium.

In the prior art goods are transported in and out of the stack at the same 25 location every time, and the stack is raised and lowered in order to guide the spaces between the different freezer plates into the correct position on a level with the goods. Hence a certain height is required over the stack, which is a disadvantage, particularly in boats, where there is a pressing need to optimize all equipment with regard to space.

The object of the invention is to provide a plate freezer where the space requirements over the stack of plates are reduced in relation to the space requirements in known plate freezers.

30 This object is achieved according to the invention with a method and devices for implementation of the method of the type mentioned in the introduction, characterized by the features which are indicated in the claims.

Thus the invention consists in the establishment of the extended space between the freezer plates in a plate freezer by lifting the stack of plates by

means of a suitable lifting device, the frame carriers are brought to the position in the stack where the extended space has to be established, and stoppers on the frame carriers are inserted over contact surfaces connected to columns on the side of the stack of plates and on into the stack, whereupon 5 the stack is lowered so that the part of the stack which is located above the stoppers remains lying on the stoppers, pressing the stoppers down towards the contact surfaces.

The weight of the stack of plates can be relatively great, and an important 10 feature of the invention is that the forces are transferred on from the stoppers, via contact surfaces on the columns down into the columns which hold the freezer plates, and over into a base. Thus there must be a contact surface for each of the levels where an extended space has to be established. The 15 stoppers and the contact surfaces may be designed in several ways. The contact surfaces, e.g., may be composed of a vertical row of contact surfaces in the form of brackets attached to the columns, or cut-outs in the columns, and the stoppers, e.g., may be composed of corresponding plates or flat bars.

In a preferred embodiment the contact surfaces are composed of horizontal 20 holes in the columns, and the stoppers are composed of horizontally movable bolts, which can be moved in and out of the holes by means of hydraulic cylinders.

In a preferred embodiment the first and second frame carriers are composed 25 of vertically movable frames or boards, which may preferably be mounted in horizontally movable carriages for movement between the conveyor and the intake and outlet sides of the plate freezer. This movement is preferably performed by means of hydraulic motors and hydraulically driven belts or chain drives, where the frames and carriages are moved on rails.

The filling of the plate freezers will be conducted sequentially, the spaces 30 being filled one by one and then placed under pressure, thus providing the greatest possible heat transfer between the goods and the freezer plates. The cooling medium is connected all the time in order to achieve the greatest possible efficiency. Due to the weight of the above-lying plates, the goods are under constant pressure even during loading and unloading of other spaces in the same plate freezer.

The process is controlled by a computer program which receives signals from different sensors, e.g. limit switches and inductive transmitters. By means of this sequential automatic control a freezing process is achieved, where one frame is always ready frozen, with the result that new freezer frames can be

5 inserted continuously.

A vertically movable pressure plate is preferably mounted on the first frame carrier in order to press the freezer frame with goods down on to the board, thus forcing air and water out of the goods which have to be frozen. This forcing out of air and water is preferably performed at the same time as the

10 first frame carrier is moved to the position where it is in alignment with the extended space. By performing these steps simultaneously, advantage is taken of the time taken by the frame carrier to move, thus improving efficiency.

In the case of known plate freezers where the stack of plates is moved vertically in order to establish the extended space at the same vertical level every time, a total space of 2,5 m is typically required over and under the stack of plates. With a plate freezer according to the invention, where the extended space is established at different levels, the stack of plates is raised and lowered only to the height necessary for establishing the extended space, typically 10-15 cm.

The invention will now be described in more detail in connection with a description of a specific embodiment, with reference to the drawing, in which

fig. 1 is a top view of a freezing plant consisting of three plate freezers, and two frame carriers mounted in carriages,

25 fig. 2 is an elevational view of a frame carrier mounted in a carriage,

fig. 3 is an elevational view of the plate freezer, the frame carriers and the carriages illustrated in fig.1, viewed in the direction of the arrow A, and

fig. 4 is an elevational view of a frame carrier and carriage illustrated in fig. 1, viewed in the direction of the arrow B.

30 The same reference numerals are employed for corresponding parts in all the figures.

Fig. 1 is a top view of a freezer plant 1 consisting of three plate freezers 2, a first frame carrier 3 on the intake side of the plate freezer and a second frame carrier 4 on the outlet side of the plate freezer. The two frame carriers are mounted in carriages 5,6. The carriages are movable along rails 7, thus enabling the frame carriers to serve the three plate freezers 2 in turn. In addition the freezer plant consists of a first conveyor which feeds the first frame carrier with freezer frames filled with goods, and a second conveyor which collects deep-frozen goods from the second frame carrier. The first and second conveyors can consist of conveyor belts, and the device for moving the freezer frames between the conveyors and the frame carriers can consist of hydraulically operated pusher means. This is outside the scope of the invention and is not illustrated. The goods in the freezer frames can consist of fresh fish packed in cardboard boxes, and the second conveyor can transport the goods to a cold store for further storage.

Fig. 2 is an elevational view of a first frame carrier 3 mounted in a carriage 5. A motor 9 and pulleys 10 for belt or chain drive move the carriage 5 horizontally along the rails 7 by means of the wheels 8. Similarly, the frame carrier 3 can be moved vertically on rails in the carriage. The devices for generating this movement are of a known type and are therefore only illustrated in a simplified form.

Fig. 2 further illustrates a vertically movable pressure plate 11. This is mounted on the first frame carrier 3 and follows its vertical movements. A bolt 12 is attached to the first frame carrier 3 and can be moved horizontally to the left/right of the figure by means of a hydraulic cylinder (not shown).

Fig. 3 is an elevational view of the plate freezer 2, the first frame carrier 3, the second frame carrier 4 and the carriages 5,6, viewed in the direction of the arrow A in fig. 1. The plate freezer 2 is illustrated in simplified form with two freezer plates, a lower freezer plate 14 and an upper freezer plate 15, vertically movable between columns 22. Fig. 3 shows how the carriage 6 like the carriage 5 is equipped with wheels 8 for horizontal movement, a motor 9 and pulleys 10 for belt or chain drive. The second frame carrier 4 can be moved vertically in the same manner as the first frame carrier 3. It is further illustrated how the second frame carrier is also equipped with a horizontally movable bolt 12, and it is shown how it is operated by a hydraulic cylinder 13. The bolts 12 on the first and second frame carriers are illustrated in a

pushed-forward state, where they are pushed through holes 21 in the columns 22, and on under the upper freezer plate 15.

The freezer plates lie on top of one another and on the freezer frames between the freezer plates with their own weight. In order to be able to push 5 a first freezer frame 16 into, and a second freezer frame 17 out of the stack of plates, an extended space therefore has to be established between two freezer plates.

A first freezer frame 16 is illustrated inside an extended space formed 10 between the lower freezer plate 14 and the upper freezer plate 15. A second freezer frame 17 is illustrated as it is in the process of being pushed out of the extended space and down on to the second frame carrier 4. A pusher means 18 with its drive unit 19 is illustrated in connection with the first frame carrier 3. In connection with the second frame carrier 4 there is 15 illustrated a stop plate 20 which can be moved between an upper position where it blocks the passage in the opening between the extended space and the second frame carrier 4, and a lower position where the passage is open.

In the method according to the invention a first freezer frame 16 is provided 20 on the first frame carrier 3 as explained above with reference to fig 1. The pressure plate 11 presses the first freezer frame 16 down towards the first frame carrier 3, thus forcing air and water out of the goods in the frame. At the same time the frame carriers 3,4, and possibly the carriages 5,6, are moved in the vertical and horizontal directions respectively in order to bring the frame carriers to the position where the extended space has to be formed. In this manner the bolts 12 on the frame carriers are brought into 25 correspondence with the holes 21 in a vertical row of holes arranged along the columns, where only the holes 21 are shown.

By means of a hydraulic cylinder (not shown), a transverse beam (not shown) 30 lifts the stack of plates in the plate freezer 2 to such a height that the upper freezer plate 15 is brought over the corresponding hole 21. The bolts 12 are guided by means of the cylinders 13 into the holes 21, in under the freezer plate 15, and the stack of plates is lowered. The freezer plate 15 and those freezer plates which are located above it thereby remain lying on the bolts 12, pressing them against the underside of the holes 21, thus transferring the weight of the freezer plates to the columns 22. The lower part of the stack of

plates is lowered in such a manner that an extended space is established between the upper freezer plate 15 and the lower freezer plate 14.

The second freezer frame 17 will often be frozen fast to the freezer plates, and it is therefore loosened by a hammer which strikes a release device (not shown).

The first freezer frame 16 is pushed into the extended space by the pusher means 18. At the same time the stop plate 20, which is normally located in the upper position, is lowered, thus opening the passage out of the extended space. The first freezer frame 16 can thereby push the second freezer frame 17 into the second frame carrier. The stop plate is raised before the second freezer frame has left the extended space, thus raising the second freezer frame slightly during the final part of its movement. The first freezer frame 16, which has not been raised during the movement, will be stopped by the stop plate, thus preventing it from sliding out on the second frame carrier.

This stop mechanism is of great importance when the freezing system is installed on board boats which are exposed to movement at sea.

The stack of plates is then raised again, thus closing the extended space and lifting the upper freezer plate 15 from the bolts. The bolts are pulled out of the holes in the columns, the frame carriers return to their positions at the conveyors, and a new sequence of placing freezer frames in the plate freezer can begin.

After a space has been filled, the stack of plates is placed under pressure by hydraulic cylinders, whereupon the frame carriers begin to fill the next space in the same or another plate freezer. The process is controlled by a computer which receives information from sensors, such as limit switches and inductive transmitters, as well as a control panel. This is prior art, and will not be described in more detail.

Fig. 4 is an elevational view of the first frame carrier 3 and carriage 5, viewed in the direction of the arrow B in fig. 1. Illustrated here are four first freezer frames 16 for parallel freezing.

With the invention, therefore, the stated object is achieved, viz. to provide a method and devices for freezing goods where the stack of plates requires less space in the vertical direction compared with the known solutions. At the

same time an energy saving and a faster freezing process are achieved, since, compared with the plate freezer mentioned at the beginning, no thawing takes place every time the freezer frames are removed from the plate freezer. By placing the stack of plates under pressure between the filling of each space, a further advantage is obtained, the heat transfer between the freezer frames and the freezer plates being improved, so that as much time as possible is devoted to freezing.

In the above, the invention has been explained with reference to a specific embodiment. It is obvious, however, that a number of variations are possible within the scope of the invention. For example, the invention is not

dependent on the use of hydraulic cylinders, since it is possible to achieve the same function with an electric motor and transfer to axial movement by means of a screw mechanism. Furthermore, it is possible to design the stoppers and the contact surfaces in several ways, e.g. the contact surfaces

may be in the form of horizontal bars which extend between the columns, and the stoppers may be in the form of plates. In the described embodiment the same stop plates are used to prevent both the first and the second freezer frames from sliding out of the extended space. These two functions can, of course, also be implemented with independent stop mechanisms, and it is also possible to omit one or both functions.

The actual design of the unit, with choice and number of freezer frames which have to be frozen simultaneously, number of plate freezers and number of freezer plates in each plate freezer, are determined on the basis of the existing conditions.

**PATENT CLAIMS**

1. A method for freezing of goods by means of one or more plate freezers (2), wherein each plate freezer consists of a stack of vertically movable horizontal freezer plates (14,15) arranged with spaces for goods, wherein the stack is provided between vertical columns (22) and has an intake side for intake of goods and an outlet side for removal of goods placed at 180° in relation to each other, and wherein the goods are frozen in a cycle which comprises the following steps:
  - 5 a) the goods are placed in a first freezer frame (16) and the first freezer frame is transferred via a first conveyor to a first frame carrier (3),
  - 10 b) the first frame carrier (3) is placed with the first freezer frame (16) on the intake side of the stack of plates,
  - c) a second frame carrier (4) is placed on the outlet side of the stack of plates, aligned with the first frame carrier (3),
  - 15 d) one of the spaces in the stack is extended, aligned with the first and the second frame carrier (3,4),
  - e) the first freezer frame (16) is pushed into the extended space, where the first freezer frame pushes a second freezer frame (17) with frozen goods out of the extended space and out on to the second frame carrier (4),
  - 20 transferring the second freezer frame to a second conveyor,whereupon the above steps are repeated for the other spaces in the stack of plates, **characterized in that step d)** is performed by
  - 25 lifting the stack by means of a suitable lifting device, preferably horizontal beams placed under the stack, which is lifted by means of hydraulic cylinders in a known per se manner,
  - moving stoppers on the first and second frame carriers (3,4) in over contact surfaces connected with the columns (22) on the intake side and the outlet side, and on into the stack, and
  - 30 lowering the stack so that the part of the stack which is located over the stoppers remains lying on the stoppers, pressing the stoppers down towards the contact surfaces, thereby forming an extended space under the freezer plate (15) which rests on the stoppers.

2. A method according to claim 1,  
**characterized in that** to step b) there is added a step where the first freezer frame (16) with its contents in the form of goods is pressed on to the first frame carrier (3) while at the same time the first frame carrier (3) is moved to  
5 the position on the intake side of the stack of plates.
3. A method according to one of the preceding claims,  
**characterized in that** step d) is followed by a step involving the activation of a stop mechanism which prevents the second freezer frame (17) from sliding out on the outlet side of the stack of plates, this stop mechanism being  
10 deactivated prior to step e).
4. A method according to one of the preceding claims,  
**characterized in that** the second freezer frame (17), which may be frozen fast to the stack of plates, is loosened by a hammer which strikes a release mechanism prior to the implementation of step e).
- 15 5. A method according to one of the preceding claims,  
**characterized in that** to step e) there is added a step where a stop mechanism (20) prevents the first freezer frame (16) from sliding out on the outlet side of the stack of plates.
6. A method according to claim 5,  
20 **characterized in that** the stop mechanism is activated while the second freezer frame (17) is in the process of being pushed out of the extended space, the stop mechanism being composed of a stopper (20) which is moved from below and upwards at the outlet side of the extended space.
7. A method according to one of the preceding claims,  
25 **characterized in that** a plurality of freezer frames (16) are conveyed in on the first frame carrier (3) and are moved together into the extended space.
8. A device for implementing the method according to claims 1 - 7,  
comprising a plate freezer (2) consisting of a stack of vertically movable horizontal freezer plates (14,15) arranged with spaces for goods, where the  
30 stack is provided between vertical columns (22), where the stack has an intake side for the intake of goods and an outlet side for the removal of goods placed at 180° in relation to each other, where before freezing the goods are placed in a freezer frame (16) which is passed via a first conveyor to the

intake side of the plate freezer (2), and where after freezing the freezer frame is transferred to a second conveyor,  
characterized in that the columns have a number of contact surfaces in the form of brackets attached to the columns (22) or cut-outs in the columns,  
5 arranged vertically along the columns, for engagement with stoppers on the first and second frame carriers, which stoppers can carry the stack of freezer plates and transfer the weight of the stack to the columns.

9. A device according to claim 8,  
characterized in that the contact surfaces are composed of a vertical row of horizontal holes (21) arranged in the columns (22), and that the stoppers are composed of horizontal bolts (12), preferably provided horizontally movable in relation to the frame carriers.

10. A device according to claim 8 or 9,  
characterized in that, since the freezer frame is passed from the first  
15 conveyor to the stack of plates and from the stack of plates to the second conveyor by a first and second frame carrier (3,4) respectively, the first and second frame carriers (3,4) are composed of vertically movable frames or boards, which are preferably respectively mounted in horizontally movable carriages (5,6).

20 11. A device according to claim 10,  
characterized in that on to the first frame carrier (3), over the position of the freezer frame (16), there is mounted a vertically movable pressure plate (11) in order to press the freezer frame with goods against the board from above, thus forcing out air and water.

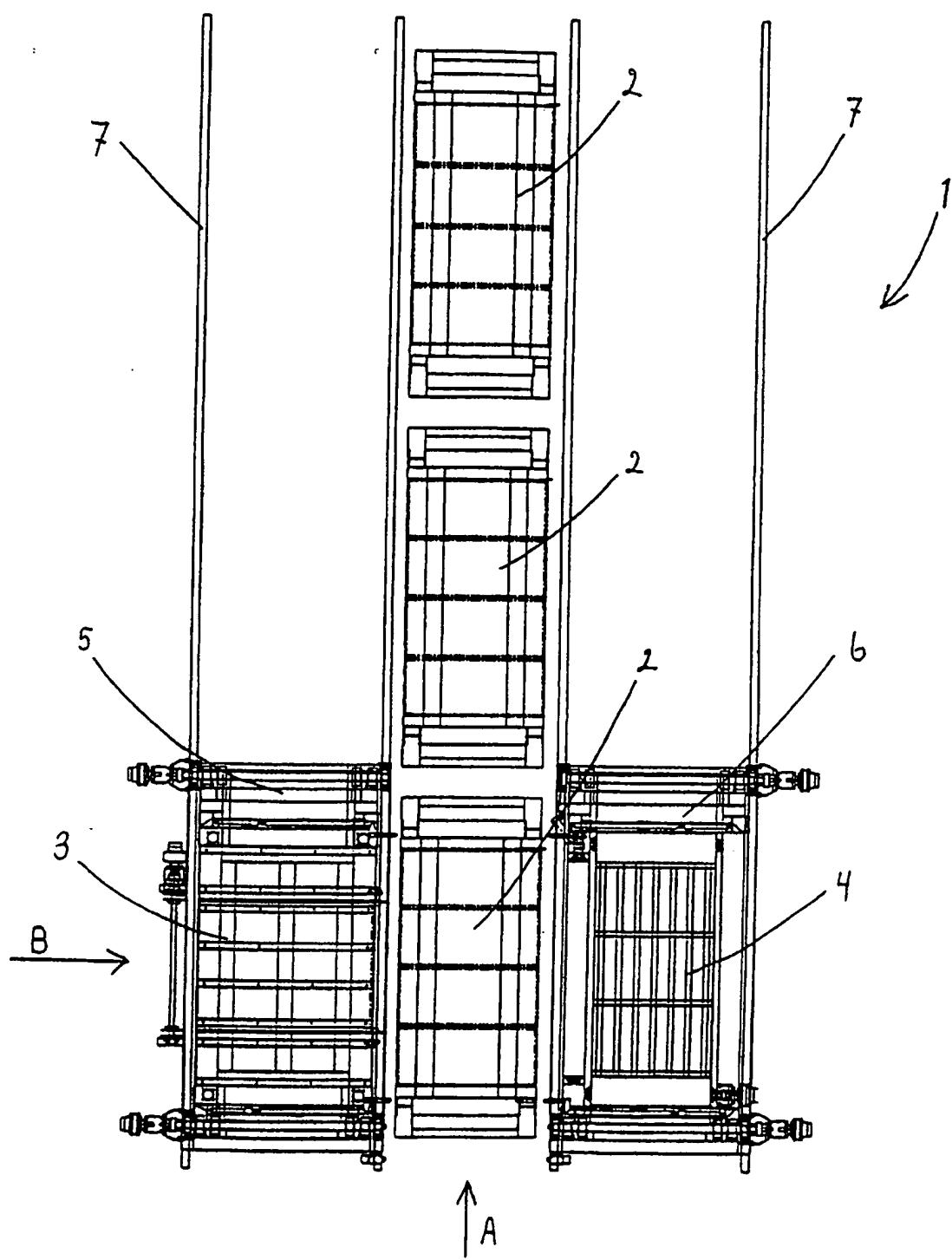


Fig. 1

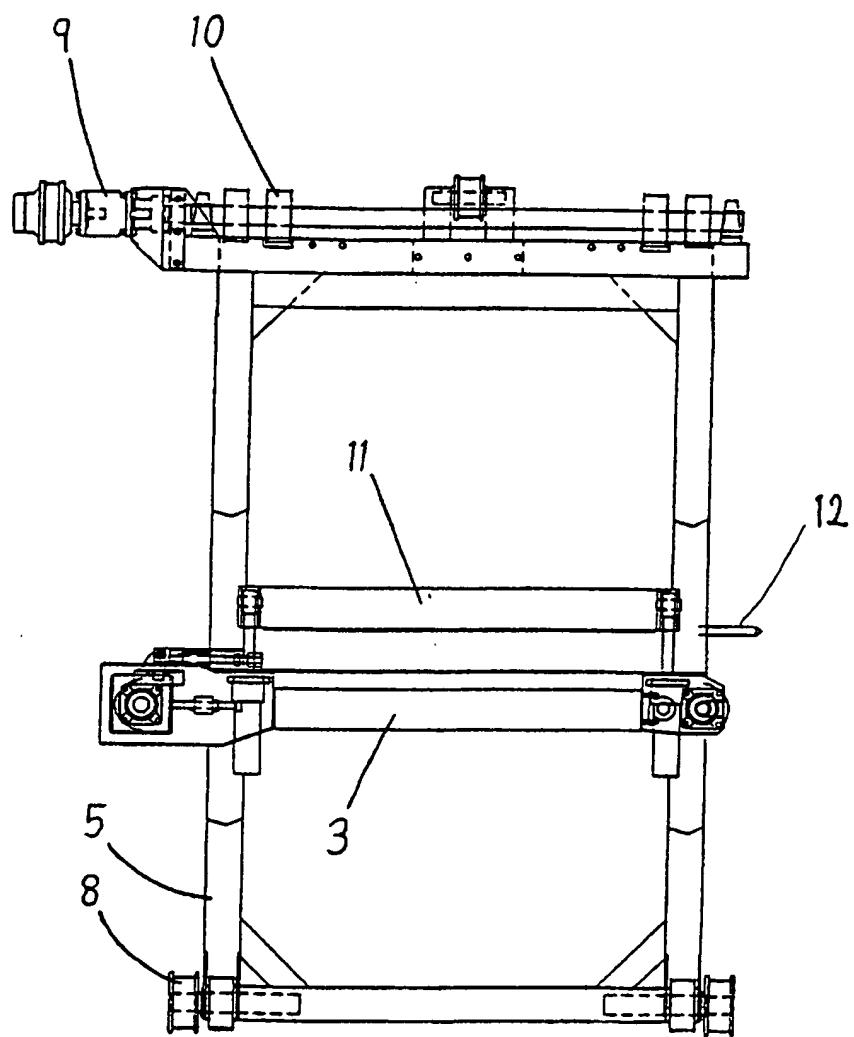


Fig. 2

3/4

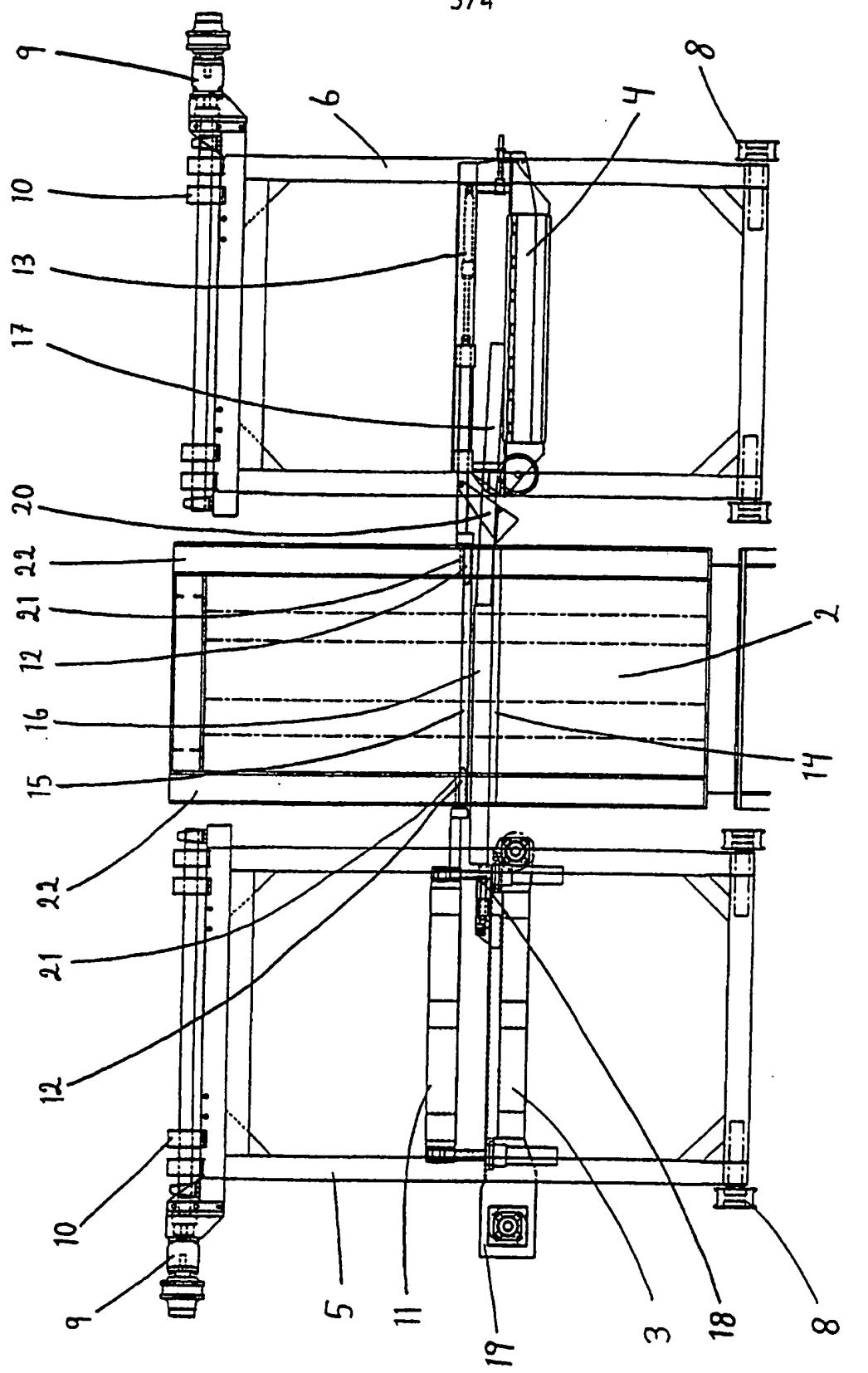


Fig. 3

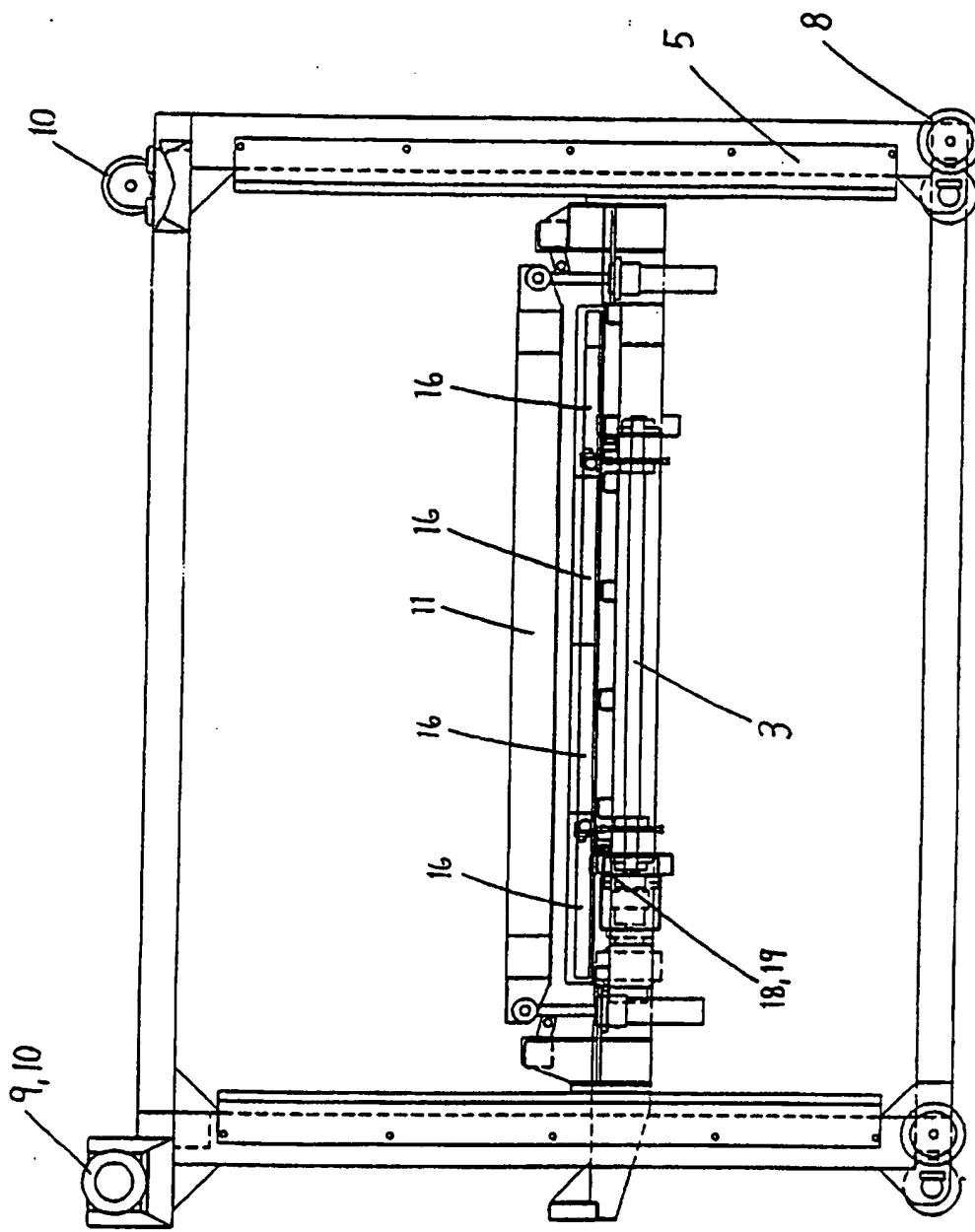


Fig. 4